

Amplitude Shift Keying ASK or ON-OFF KEYING OOK

- ❑ It is the simplest digital modulation technique.
- ❑ There is only one carrier and it is switched ON or OFF depending upon the input binary sequence.
- ❑ The output equation of ASK modulator, $s(t)$ can be written as:

$$s(t) = \sqrt{2P_s} \cos(2\pi f_o t)$$

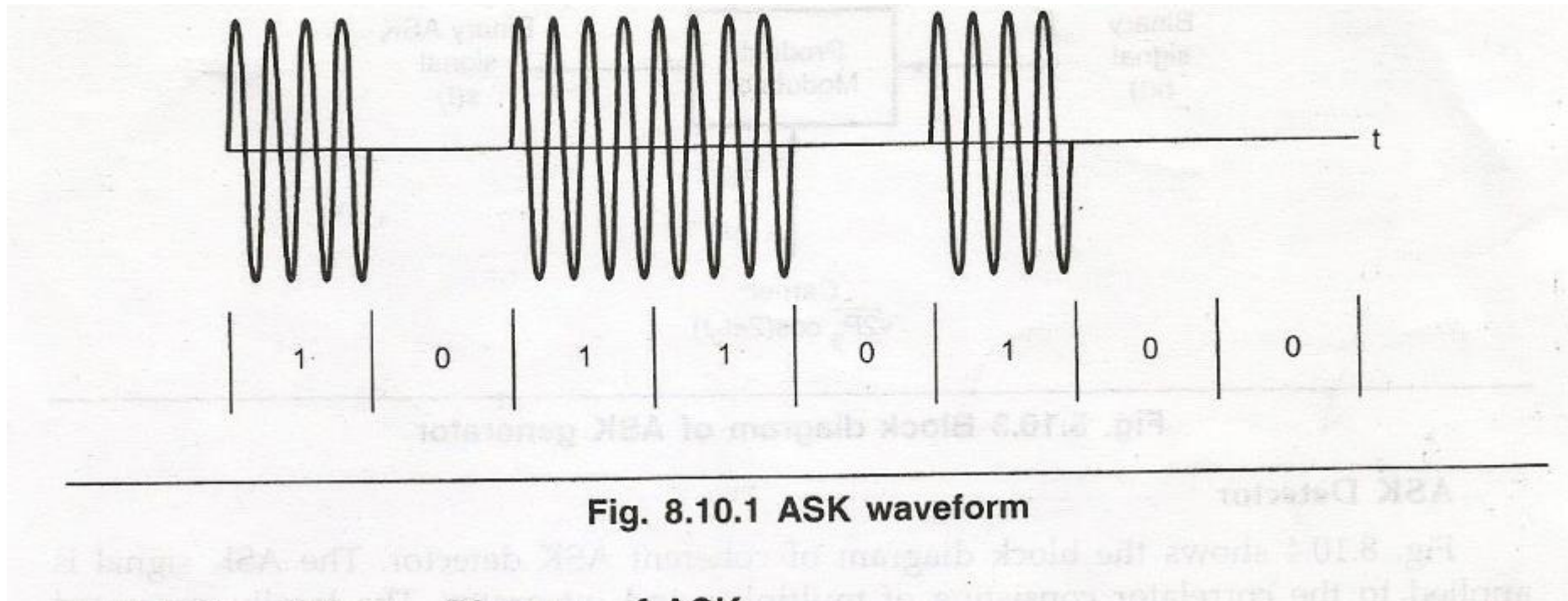
where $\sqrt{2P_s}$ is constant carrier amplitude and

f_o is the carrier frequency

- ❑ There are two symbols, one for “1” and other for “0”
- ❑ The symbol contain some complete cycles of carrier.
- ❑ To transmit “1” $s(t)$ is transmitted
- ❑ While no signal($s(t)$) transmitted for “0”

CONTINUE

- Thus the ASK waveform looks like an ON- OFF of the signal. Hence it is also called ON – OFF Keying (OOK). Fig. below shows the ask signal.



Generation and Detection of ASK

Product
Modulator

ASK Generator

Fig. 8.10.3 shows the ASK generator. The input binary sequence is applied to the product modulator. The product modulator amplitude modulates the sinusoidal carrier. It passes the carrier when input bit is '1'. It blocks the carrier (i.e. zero output) when input bit is '0'. The waveform of ASK is as shown in Fig. 8.10.1.

Binary Signal
 $B(t)$

**Product
Modulator**

Binary ASK signal
 $S(t)$

Carrier

ASK Detector

Fig. 8.10.4 shows the block diagram of coherent ASK detector. The ASK signal is applied to the correlator consisting of multiplier and integrator. The locally generated coherent carrier is applied to the multiplier. The output of multiplier is integrated over one bit period. The decision device takes the decision at the end of every bit period. It compares the output of integrator with the threshold. Decision is taken in favour of '1' when threshold is exceeded. Decision is taken as '0' if threshold is not exceeded.

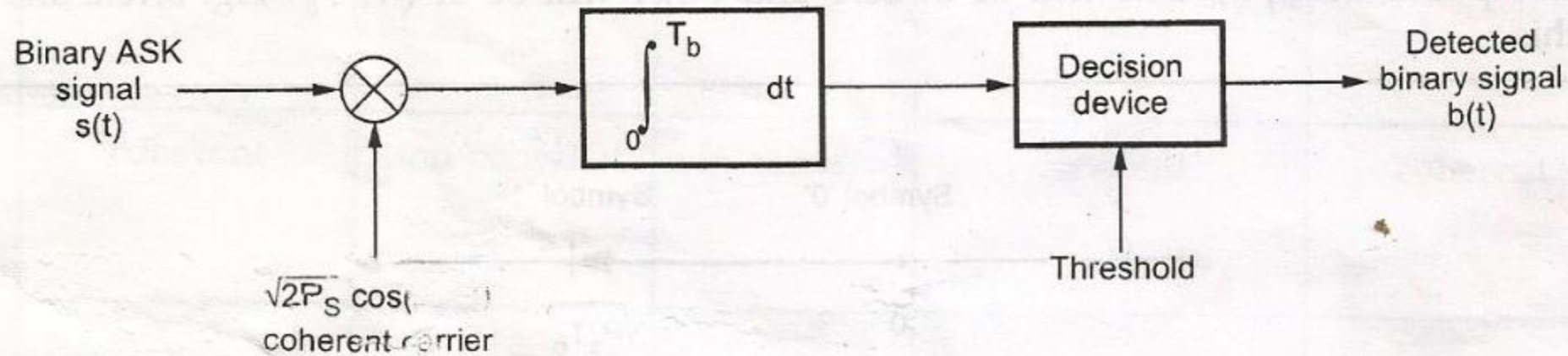


Fig. 8.10.4 Block diagram of coherent ASK detector

Comparison of Digital Modulation techniques

Table 8.11.1 shows the comparison of various digital modulation techniques. They are compared on the basis of various parameters like bits transmitted per symbol, detection method, Euclidean distance, bandwidth, error probability, symbol duration etc. Various other important parameters like bandwidth efficiency, spectrum of transmitted signal etc are not compared. QPSK, ASK have amplitude variations hence noise interference is more in these techniques. Normally PSK and FSK methods have less noise interference. M-ary techniques are more complex compared to binary techniques.

Table 8.11.1 Comparison of digital modulation techniques

Sr. No.	Parameter	BPSK	DPSK	QPSK	M-ary PSK
1	Modulation of	Phase	Phase	Phase	Phase
2	Equation of the transmitted signal $s(t)$	$s(t) = b(t) \sqrt{2P_s} \cos(2\pi f_0 t)$	$s(t) = b(t) \sqrt{2P_s} \cos(2\pi f_0 t)$ $b(t)$ differentially coded	$s(t) = \sqrt{2P_s} \cos[2\pi f_0 t + (2m+1) \frac{\pi}{4}]$ $m = 0, 1, 2, 3$	$s(t) = \sqrt{2P_s} \cos(2\pi f_0 t + \phi_m)$ $\phi_m = (2m+1) \frac{\pi}{M}$ $m = 0, 1, 2, \dots, M-1$
3	Bits per symbol	one	one	Two	N
4	Number of possible symbols $M = 2^N$	two	two	four	$M = 2^N$
5	Detection method	coherent	non coherent	coherent	coherent
6	Minimum Euclidean distance between signal points	$2\sqrt{E_b}$	-	$2\sqrt{E_b}$	$2\sqrt{E_s} \sin \frac{\pi}{M}$
7	Minimum Bandwidth (BW)	$2f_b$	f_b	f_b	$\frac{2f_b}{N}$
8	Symbol duration (T_s)	T_b	$2T_b$	$2T_b$	NT_b

QASK	BFSK	M-ary FSK	MSK	ASK
amplitude and phase	frequency	frequency	frequency	amplitude
$s(t) = k_1 \sqrt{0.2P_s} \cos(2\pi f_0 t) + k_2 \sqrt{0.2P_s} \sin(2\pi f_0 t)$ $k_1, k_2 = \pm 1 \text{ or } \pm 3$ for $M = 16$	$s(t) = \sqrt{2P_s} \cos[2(\pi f_0 + d(t)\Omega)t]$ $\Omega \text{ is frequency shift.}$	$s(t) = \sqrt{2P_s} \cos(2\pi f_i t)$ $i = 1, 2, \dots, M$	$s(t) = b_o(t) \sqrt{2P_s} \sin 2\pi \left[f_0 + b_e(t) b_o(t) \frac{f_b}{4} \right] t$ $b_e(t), b_o(t) = \text{odd/even sequence}$	$s(t) = 2\sqrt{2P_s} \cos(2\pi f_0 t)$ for symbol '1' = 0 for symbol '0'
N	one	N	Two	one
$M = 2^N$	two	$M = 2^N$	four	two
coherent	non coherent	non coherent	coherent	coherent
$\sqrt{0.4E_s}$ for $M = 16$	$\sqrt{2E_b}$	$\sqrt{2NE_b}$	$2\sqrt{E_b}$	$\sqrt{E_b}$
$\frac{2f_b}{N}$	$4f_b$	$\frac{2^{N+1}}{N} f_b$	$15f_b$	$2f_b$
NT_b	T_b	NT_b	$2T_b$	T_b